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Original Research

The Impact of the Activity of Industrial Engineering Researchers in Various Scientific-Citation Networks on Improving their Scientific Authority Status

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Abstract

This study analyzes the link between Mendeley indexes of scientific-citation networks and Scopus, taking into account the beneficial influence of researchers' actions in social networks on scientometric indices of works indexed in databases like Google scholar and WoS. In this basic/descriptive study, we use the Altmetrics approach to describe Iranian researchers' activities in industrial engineering in scientific-citation networks. In this study, researchers whose activities are recorded with Iranian affiliation in scientific-citation networks have been briefly named Iranian researchers. The corpus of the study included the works of 160 Iranian researchers in the field of industrial engineering, indexed in the Scopus in the period 2000-2019. To test the likely correlation between the measures of social networks (SN) activities with scientometric ones, simple and multiple correlation tests were carried out by Excel and SPSS software .The correlation between the number of times a document was read, the number of citations, and the measures in the Mendeley, Scopus, We of Science (WoS), and Google Scholar (GS) was very high. However, the correlation between the number of readers in the Mendeley and co-authorship in Scopus was low. There was a strong correlation between the number of citations in Mendeley and that in other databases. The correlation between the authors' H-index in the Mendeley database and other databases is positive and significant, stronger in Scopus and WoS than Google Scholar. It was finally concluded that researchers' activities in social networks attract more readers, increase the number of citations and thus increase the H-index score in databases. Therefore, they need to be more active in social networks to increase their H-index score and promote academic publications.

Keywords: Scientometric, Altmetrics, Mendeley, Scopus, WoS, Google Scholar.

Introduction and problem statement

The emergence of social networks has facilitated communication between individuals by removing geographical, social, political restrictions. Social networks can increase reading opportunities. Social networking platforms such as LinkedIn, ORCID, Research Gate, Twitter, Facebook, and YouTube are great tools for advancing research. Now that social media platforms have created a platform for science sharing, science-citation networks have come to the aid of social media, giving researchers and authors more power to share research resources and findings. Scientific citation networks enable researchers to communicate with colleagues in various fields, making it possible to access up-to-date scientific fields (Biranvand & Shanbedi, in press,b).

The emergence of scientific-citation networks and their impact on scientific communication and publication of research findings on the one hand and the shortcomings of traditional methods in measuring the impact of scientific publications, on the other hand, triggered the introduction of new indexing mechanisms. Altmetrics is an emerging mechanism to evaluate the impact of scientific publications on social and scientific networks. Altmetrics complements citation metrics that evaluate scientific and research findings (Biranvand & Shanbedi, in press, a). Many researchers use new web technologies such as social networks, blogs, forums, and databases. Moreover, the limitations of citation-based methods in measuring scientific influences in virtual environments have given birth to Altmetrics (Priem, Taraborelli, Groth & Neylon, 2010).

Information sharing is a vital factor for scientific, social networks. Social networks help researchers identify other peers and researchers, communicate with them, and develop specialized knowledge. Despite some obstacles in measurement, Altmetrics indicators can complement traditional indicators of scientific knowledge to evaluate the performance and effectiveness of scientific publications (Bornmann, 2014; Costas et al., 2015; Ouchi et al., 2019; Sugimoto, Work, Larivière & Haustein, 2017). Therefore, researchers can play an important role in disseminating their scientific findings through the capabilities of social media. Social media provide increased viewing, reading, feedback, and citation by sharing research findings. Therefore, research on academic social networks by faculty members is essential. Moreover, studying knowledge sharing among faculty members can illuminate how the scientific community uses this communication technology. It is also vital to study the scientific communities' attitude towards knowledge sharing because a negative attitude is one of the main challenges of universities in the age of communication and an influential factor in knowledge management (Fullwood, Rowley & Delbridge, 2013).

One of the factors showing the importance of scientific interaction and participation through socio-scientific networks is the study of the status of highly cited articles in scientific fields. Examining the relationship between the number of citations received by articles in scientific databases and the number of times the articles are viewed in socio-scientific networks provides a clear understanding of the role of authors' activities in social networks. Scientific social networks may be beneficial to researchers and scholars, as they increase the rate of reading and receiving citations from others. Thus, this study examines the activities of Iranian researchers in the field of Industrial engineering in Mendeley and its relation with scientometric indicators of scientific-citation databases of Scopus, WoS, and Google Scholar. Accordingly, and in line with the primary purpose of the research, the following questions were raised:

1. To what extent are Iranian researchers in industrial engineering active in Mendeley,

Scopus, WoS, and Google Scholar databases?

2. Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and Scopus databases?

3. Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and WoS?

4. Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and Google Scholar?

5. Is there a correlation between the number of citations received by Iranian researchers in the field of industrial engineering in Mendeley, Scopus, WoS, and Google Scholar?

6. Is there a correlation between the H-Index of Iranian researchers in the field of industrial engineering in Mendeley, Scopus, WoS, and Google Scholar databases?

The theoretical framework of research

Social Networks

One of the products of Web 2 is social networks. Social networks are a group of internet-based applications that rely on the technological foundations of Web 2 to create and share user-generated content. Users can share comments and knowledge through social-scientific networks (Van Acker et al., 2014). Mendeley Social-Citation Network is a reference management tool that allows researchers to manage, tag, cite, and share scientific articles. Researchers may also use this tool to create a public profile, publish their research findings, and link with researchers in their field. Mendeley calculates how many times an article is "read" (i.e., how many times Mendeley users flag it), thus providing information about researchers' interactions with the scientific community. Thus, the number of Mendeley users who view a particular article or journal potentially indicates how many times they read it (Pooladian & Borrego, 2017).

Altmetrics

Altmetrics, based on Web 2 technologies and social networks, is a measuring tool for researchers' scientific activities. It was developed a little over 10 years ago to examine the impact of scientific works or track them when mentioned online on social networks and news. It counts the number of readers, views, and other interactions (Priem et al., 2010). Altmetrics describes web-based standards for scientific documentation, emphasizing social network outputs as data sources. Altmetrics measures the number of times a publication has been researched, offered, tweeted, liked, subscribed, bookmarked, viewed, downloaded, mentioned, followed, reviewed, or discussed. Unlike quotes, which take longer to impact, online interaction is fast and can be tracked faster (Fang & Costas, 2018). Proponents of using algorithms want to complete citation-based metrics to complete a broader range of metrics to show the impact of publications. There are several operating systems today that offer Altmetrics counters, including PlumX. These platforms track the Internet for usage, reading, social media, and news network’s coverage. Their sources are Mendeley, Twitter, Facebook, blogs, Wikipedia, Reddit, and the mainstream scientific news (Bar-Ilan (Deceased) & Halevi, 2020).

Research background

With the development of Web 2 technology, social networks such as Facebook, Twitter, blogs, Wikipedia, Mendeley, resource management tools are helping researchers share information more securely. These methods are different and more explicit than traditional ones. Traditional methods and indicators are no longer useful for measuring new social media behaviors (Ouchi, 2019). Therefore, in recent research, Altmetrics indices have been used as alternative metrics to traditional methods to measure and evaluate research and calculate the extent of scientific impact. The results of previous research show that Altmetrics indices can be used to measure the impact of research and the performance of researchers. Studying social networks to develop and share knowledge among Iranian authors, some researchers (Biranvand & Shanbedi, in the press, a; Biranvand & Shanbedi, in the press, b; Biranvand, Samie & Rahmaniyan, 2021; Biranvand & Ghanaatian (in press) show that there is a positive correlation between Altmetrics scores in social networks and database scientometric indicators. This finding indicates the importance of working in social networks, using citation databases, and sharing scientific products through them. Studying the relationship between the number of ,citationsH-index citations, and co-authorship in Scopus with the metrics of citation number, number of readers, RJ score, and the number of followers in ResearchGate, Biranvand et al. found a positive and significant correlation among them (Biranvand et al., 2021). ,However Asaad, Howell, Rajesh, Meaike & Tran (2020). found no general correlation between citations received in the journal of cosmetic Surgery and Altmetric score.

Studying the use of the ResearchGate and Academy social network among Japanese researchers, Mason (2020) found that they are more inclined to use the ResearchGate network than Academy social network because of its popularity. Sathianathen et al. (2020) showed that social media predicts citations and can be used as an early measure of scientific impact. Biranvand and Shanbady (2020) studied the relationship between ResearchGate Altmetric indicators and other indicators. They found a significant relationship between ResearchGate Altmetric indexes and Scopus, WoS, and Google Scholar databases. They also found a positive and significant relationship between the Altmetric of ResearchGate and Mendeley social networks and the scientometric databases indexes of Scopus databases (Biranvand and Shanbady, 2020). Ravan et al. (2018) studied the relationship between heterogeneity indices of articles in plastic surgery with citations received in Scopus. They found no observable correlation between heterogeneity scores and Scopus citations. Still, the relationship between heterogeneity scores and the number of times articles are read through Mendeley was significant. Susarla and Frederick (2018) found a positive correlation between the number of articles read in Mendeley and the Altmetric score physicians obtained on social media. Hughes, Hughes & Murphy (2017) showed that the number of retweets of journals and their Altmetric scores is related to each other significantly and positively. Unioet et al. (2017) studied the effects of physicians' activities in virtual networks on increasing citations. They found that the number of citations received in virtual networks is significantly related to the citation through databases.

In sum, the positive correlation between Altmetric scores in social networks and scientometric indicators of databases shows the importance of activity on social networks, using citation databases and sharing scientific articles through them (Biranvand et al., 2021; Biranvand and Shanbadi, in the press, b; Susarla & Friedrich, 2018). Furthermore, a significant relationship between the presence of a scientific article in social networks and the increase of

its citations in scientific databases has been reported in most studies. Yet, Asaad et al. (2020) found no relationship between Altmetric scores and citations received, suggesting disciplinary differences. To fill the research gap, we studied the effect of Altmetric indices related to Mendeley on scientometric indices of Scopus, WoS, and Google Scholar databases in this article. We wish to understand the impact of social media activity on scientometric indicators of databases in the field of industrial engineering.

The following summarizes researches in this field (Table 1).

Table 1
Summary of research background

relationship betweenalt-metric scores in Research Gate social network and scientometrics of Scopus database	The relationship between the number of citations, citations Hindex, and co-authorship in Scopus with the metrics of citation number, citations, Hindex, readers, RJ score, and followers in ResearchGate is positive and significant.	(Biranvand et al., ۲۰۲۱)
Relationship between Article Citation andAlt-metricsScore and Social Media	There is no general correlation between citations received in the Journal of Cosmetic Surgery and Altmetric score.	(Asad et al., ۲۰۲۰)
Comparison of the use of the Research Gate and Academy social network among Japanese researchers	Japanese researchers are more inclined to use the Research Gate network because Research Gate has been introduced much more passively than the Academy. The language factor is one of the barriers to using social networks.	(Mason, 2020)
A review of the impact of social media on citations to articles received in Scopus	Social media predicts citations and can be used as an early measure of scientific impact. Social media coverage is approximately ۱٤ days after the document is released.	(Sathianathen et al. 2020)
Relationship between Research G ateAlt-metric Indicators on Database Indicators	There is a significant relationship between Research Gate social network Alt-metric ,indices and Scopus WoS and Google Scholar databases.	(Biranvand &Shanbadi, 2020)
Impact of Research Gate and MendeleySocial MediaAlt-metric Indices on Scopus Scientometrics	There is a positive and significant relationship between theAlt-metrics of Research Gate and Mendeleysocial networks (except for the metered followers) and the scientometric indices of Scopus database.	(Biranvand &Shanbadi, 2020)
Relationship between heterogeneity indices of articles in the field of plastic surgery with citations received in Scopus	There is no obvious correlation between heterogeneity scores and Scopus citations. But there is a significant relationship between heterogeneity scores and the number of times articles are read through Mendeley.	(Ravan et al., ۲۰۱۸)
relationship between reading articles in Mendeley ,downloads , Alt-metricscore of articles in the field of	There is a positive correlation between the number of articles read in Mendeley and theAlt-metricscore obtained by physicians on social media.	(Susarla and Friedrich, 2018)

plastic surgery		
relationship between the impact factor ofjournals using Twitter on the home page of journals	Journals with more retweets (virtual citations on Twitter) have higher altitude scores. In fact, there is a positive and significant relationship between the number of tweets ofjournals and their Alt-metric.score	(Hughes et al., ۲۰۱۷)
effect of physicians' activities in virtual networks and increasing citations	There is a significant correlation between the amount of citations received in virtual networks and citations through .databases	(Unioet al., ۲۰۱۷)

Research method

The present study is a basic/quantitative research investigating the relationship between the Altmetrics indices of Mendeley scientific-citation network and Scopus, WoS, and Google Scholar databases. Thematic and temporal scope of the research is related to the indexed works of 160 Iranian researchers in industrial engineering with the highest documents in the Scopus database in 2000-2019 and at the time of the research (15/05/2020). They were members of the Mendeley Scientific-Citation Database. Sampling was not performed in this study due to the possibility of non-membership of all community members introduced from Scopus in Mendeley. Then, by referring to the personal pages of these researchers in Mendeley, Altmetric scores were extracted to evaluate the research objectives. Although the data collected from the databases do not need to be checked for validity and reliability, the normality of the data was verified and confirmed. Pearson correlation test was used to examine the correlation among research variables. The applications used were Excel and SPSS. The process of searching documents was done through the following search command:

(AFFILCOUNTRY (Iran) AND PUBYEAR> 1999 AND PUBYEAR <2020 AND (LIMIT-TO (SUBJAREA, "DECI")))

It is worth mentioning that all Iranian authors identified in the Scopus database were included in the study, although some may not be in Iran.

Findings

The findings are reported in two sections: descriptive findings and inferential findings. The descriptive findings section presents the variables' average, minimum, maximum, and median indices. In the inferential findings section, the Spearman correlation coefficient examines the relationship between the indicators studied in Mendeley, Scopus, Web- of- Science, and Google Scholar.

Descriptive findings

Indicators of the number of documents, citations received, and the score index of each author of the population of the research is provided in Table 2.

Based on the information in Table 2, the following results can be seen:

- The largest number of documents indexed in the Scopus database is 1018 documents related to Balakrishnan, N.
- The largest number of documents indexed on the WoS website is 7267 documents related to Govindan, K.
- The largest number of documents indexed in the Mendeley database is 388 documents

related to Meybodi, M.R. Is.

- The highest number of citations received on the Scopus database is 14,867 citations from Govindan, K.
- The highest number of citations received on the WoS website is 12,750 citations from Govindan, K.
- The highest number of citations received in the Mendeley database is 13825 citations related to Balakrishnan, N.
- The highest number of citations received on Google Scholar is 74,729 from Balakrishnan, N.
- The highest scoring index on the Scopus database is 68, which belongs to Govindan, K.
- The highest HTML index score received on the WoS website is 63, related to Govindan, K.
- The highest HTML index score obtained on the Mendeley is 51, related to Balakrishnan, N.
- The highest HTML index received on Google Scholar is 85 belonging to Govindan, K.

Table 2
Indicators in Scopus, WoS, Google Scholar and Mendeley Social Citation Databases

		Scopus			Web of Science			Google Scholar			Mendeley		
Row	Researchers	Number of documents	Number of citations	H-Index	Article Citing	H-Index	T-S Cited	Number of citations	H-Index	I10 Index	H-Index	Number of citations	Number of documents
1	Reza Tavakoli Moghaddam	520	8390	46	4817	43	6762	13963	59	311	46	8431	29
2	Ali Azadeh	442	5786	38	2784	34	3803	10032	50	250	38	5916	
3	Balakrishnan, N.	1018	13825	51	3031	36	5737	74729	83	563	51	13825	
4	Jafar Ahmadi	115	933	18	533	19	964	1747	24	54	18	933	102
5	Massoud Rabbani	197	2598	29	1663	26	1985	4846	36	101	29	2598	
6	Seyyed Taghi Akhavan Niaki	283	4484	38	2292	33	3655	6854	48	166	38	4484	250
7	Attaullah Talibzadeh	150	2953	37	997	29	2052	4288	43	91	37	2952	
8	Bijan Duaz	443	5775	39	1995	39	5922	10382	49	232	39	5776	
9	Majid Asadi	78	947	15	556	17	1024	113	6	2	16	1022	
10	Seyed Ali Torabi	140	3937	32	2542	31	3596	6934	41	100	32	4023	17
…													
160	Mohsen Mohammadzadeh	43	216	9	5	1	5	430	12	17	9	220	

Descriptive findings related to the indicators of research variables

Table 3 presents the variable indexes used for each scientific-citation database.

Table 3
Average Median, minimum, and maximum of research variables

	Index	Average	Median	Minimum	Maximum
Scopus	Number of documents	110.94	65.5	14	1018
	Citations	1528.98	848.5	7	14867
	H-index	17.61	15	1	68
Web of Science	citation	1026.1	590	7	8586
	Co-author	101.88	62.5	2	2510
	Publishers	1233.49	676	1	12750
	H-index	16.12	14	1	63
	Citations	827.90	490	1	7267
Mendeley	H-index	17.23	15	1	51
	Citations	1463.72	803	7	13825
	Publishers	72.92	53	9	388
	view	59844.47	35895	1178	338788
Google Scholar	Citations	3347.64	1576	50	74729
	H-index	24	21	4	85
	I10-Index	60.4	38	1	563

As shown in Table 3, the highest average publications/number of documents are related to WoS with 827.90 cases, Scopus with 110.94 cases, Mendeley with 72.92 cases, and Google Scaler with 60.4 cases, respectively. The highest average number of citations received was related to Google Scholar with 3347.64 citations, Scopus with 1528.98 citations, Mendeley with 1463.72 citations, and WoS with 1233.49 citations. The highest average H-index index is related to Google Scholar equal to 24, Scopus equal to 17.61, Mendeley equal to 17.23, and WoS equal to 16.12, respectively.

Answering the first research question: to what extent are Iranian researchers in the field of industrial engineering active in Mendeley, Scopus, WoS, and Google Scholar databases?

Regarding the presence of Iranian top production authors in industrial engineering in Scopus, WoS, Mendeley, and Google Scholar databases, 160, 160, 141, 145 people out of 160 authors in this study are active. This information indicates the presence of authors in these databases. Authors are more interested in using Scopus and WoS than other sites. These data indicate insufficient attention of researchers in this field to use Mendeley resource management database and Google Scholar. The number of documents available in Scopus, Web- of- Science, and Mendeley are17751, 132465, and 2771 documents. We were unable to identify the number of documents indexed in Google Scholar. According to the number of documents indexed in these databases, it can be concluded that the authors use WoS, Scopus, and Mendeley to publish their works.

Inferential findings

Kolmogorov-Smirnov test was used to check the distribution of the research variables' normality. The test results for the normality of research variables are presented in Table 4.

Table 4.
Results of Kolmogorov-Smirnov test to measure the normality of the distribution of variables

Variable	Scopus	Web of Science	Google Scholar	Mendeley
Number of documents	0.000	0.000	---	0.000
Citations	0.000	0.000	0.000	0.000
H-index	0.000	0.000	0.000	0.000
readers	---	---	---	0.000
Viewers	---	---	---	0.000
I10-Index	---	---	0.000	---

As shown in Table 4, the significance level for the Kolmogorov-Smirnov statistic for all variables is less than 0.05, so variables do not violate the assumptions of parametric tests. As a result, the Spearman correlation test can be used for this data type.

Answering the second research question: Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and Scopus databases?

The results of the correlation coefficient test between Altmetrics indices of Iranian researchers in the field of industrial engineering in Mendeley and Scopus databases are presented in Table 5.

Table 5
The correlation coefficient between Altmetrics indices in Mendeley and Scopus.

			Scopus				
			Number of documents	Citations	H-Index	citation	Co-author
Mendeley	H-index	Correlation coefficient	0.847** 0.000	0.959** 0.000	0.992** 0.000	0.937** 0.000	0.848** 0.000
	Citation	significance level Correlation	0.815** 0.000	0.990** 0.000	0.950** 0.000	0.972** 0.000	0.835** 0.000
	Publishers	coefficient significance level	0.582** 0.000	0.445** 0.005	0.487** 0.002	0.416** 0.009	0.457** 0.004
	viewers	Correlation coefficient significance level	0.648** 0.000	0.836** 0.000	0.834** 0.000	0.851** 0.000	0.753** 0.000
		Correlation coefficient significance level					

**. Significance at the level of 0.05. Not significance (ns.) at the level of 0.05.

Analysis of the data obtained from Table 5 shows a significant correlation between the Altmetrics indices of researchers in Mendeley and Scopus databases (significant level 0.05). There is no significant relationship between Mendeley scientific social network followers and H-index in the Scopus scientific-citation database ($p < 0.05$). However, there is a significant correlation between other Altmetrics indicators of Iranian researchers in the management field in Mendeley and Scopus scientific-citation database ($p < 0.05$).

Answering the third research question: Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and WoS?

The relationship between the Altmetrics indices of Iranian researchers in Industrial Engineering in Mendeley and WoS is presented in Table 6.

Table 6
The correlation coefficient between Altmetrics indices in Mendeley and Web -of –Science

			WoS	
			Citation	H-index
Mendeley	H-index	Correlation coefficient	0.871**	0.901**
		significance level	0.000	0.000
	Citation	Correlation coefficient	0.906**	0.873**
		significance level	0.000	0.000
	Publishers	Correlation coefficient	0.278^{ns}	0.314^{ns}
		significance level	0.091	0.055
	Viewers	Correlation coefficient	0.651**	0.653**
		significance level	0.000	0.000

**. Significance at the level of 0.05. Not significance (ns.) at the level of 0.05.

As shown in Table 6, there is a significant relationship between co-authorship index, H-index, citation received, readers, publications, and viewers in Mendeley and indexes of citation number and H-index in Web- of-Science citation database ($p < 0.05$). However, there was no significant relationship between the followers' index and the number of citations and HTML indexes in the WoS ($p < 0.05$).

Answering the Fourth research question: Is there a correlation between Altmetrics indices related to Iranian researchers in the field of industrial engineering in Mendeley and Google Scholar?

The results of the correlation coefficient test between Altmetrics indices of Iranian authors and researchers in the field of industrial engineering in Mendeley and Google Scholar are presented in Table 7.

Table 7
The correlation coefficient between Altmetrics indexes in Mendeley and Google Scholar

			Google Scholar		
			Citation	H-index	I10 Index
Mendeley	H-index	Correlation coefficient	0.905**	0.920**	0.892**
		significance level	0.000	0.000	0.000
	Citation	Correlation coefficient	0.917**	0.885**	0.864**
		significance level	0.000	0.000	0.000
	Publishers	Correlation coefficient	0.493**	0.481**	0.522**
		significance level	0.002	0.003	0.001
	viewers	Correlation coefficient	0.769**	0.775**	0.636**
		significance level	0.000	0.000	0.000

**. Significance at the level of 0.05. Not significance (ns.) at the level of 0.05.

Examination of the results of Table 7 shows a correlation between the indexes of co-authorship, H-index, citation received, readers, publications, and viewers in Mendeley and citation indexes, I10 index in Google Scholar ($p < 0.05$). Moreover, there is a significant correlation between the followers' index in Mendeley and the I10-index in the Google Scholar

citation database; however, the correlation between this index and citation indexes and H-index in the Google Scholar citation database is not significant ($p < 0.05$).

Answering the fifth research question: Is there a correlation between the number of citations received by Iranian researchers in the field of industrial engineering in Mendeley, Scopus, WoS, and Google Scholar?

Spearman correlation coefficient was used to examine the relationship between Scopus, WoS, Google Scholar, and Mendeley databases. The results of this test are reported in Table 8.

Table 8

The correlation coefficient between the numbers of citations received in Mendeley, Scopus, WoS, and Google Scholar databases.

		Scopus	WoS	Google Scholar	Mendeley
Scopus	Correlation coefficient	1			
	significance level				
Web of Science	Correlation coefficient	0.855**	1		
	significance level	0.000			
Google Scholar	Correlation coefficient	0.929**	0.797**	1	
	significance level	0.000	0.000		
Mendeley	Correlation coefficient	0.972**	0.930**	0.945**	1
	significance level	0.000	0.000	0.000	

**. Significance at the level of 0.05. Not significance (ns.) at the level of 0.05.

As shown in Table 8, there is a significant relationship between the number of citations received in the Scopus database and the number of citations received in the Web- of- Science ($p < 0.05$). Moreover, there is a significant relationship between the number of citations received in the Scopus database and the number of citations received in the Google Scholar database ($p < 0.05$). Finally, there is a significant relationship between the number of citations received in the Web -of -Science database and the number of citations received in the Google Scholar database ($p < 0.05$).

Answering the sixth research question: Is there a correlation between the H-Index of Iranian researchers in the field of industrial engineering in Mendeley, Scopus, WoS, and Google Scholar databases?

The relationship between the H-Index score in the Scopus, WoS, Google Scholar, and Mendeley databases was tested using the Spearman correlation coefficient. The results of this test are reported in Table 9.

Table 9
The correlation coefficient between H-index index in Scopus, Web of Science, Google Scholar, and Mendeley databases.

		Scopus	WoS	Google Scholar	Mendeley
Scopus	Correlation coefficient significance level	1			
Web of Science	Correlation coefficient significance level	0.849** 0.000	1		
Google Scholar	Correlation coefficient significance level	0.925** 0.000	0.796** 0.000	1	
Mendeley	Correlation coefficient significance level	0.693** 0.000	0.616** 0.000	0.670** 0.000	1

**. Significance at the level of 0.05. Not significance (ns.) at the level of 0.05.

Based on the data in Table 9, there is a positive and significant relationship between the H-index of the studied databases. The correlation between the HTML index score in the Google Scholar and Scopus databases is very high, and so is that between WoS and Scopus ($p < 0.05$). In addition, there is a significant relationship between the H-index in the Scopus database and the H-index in the WoS database ($p < 0.05$). Moreover, there is a significant relationship between the H-index in the Scopus database and the H-index in the Google Scholar database ($p < 0.05$). Finally, there is a significant relationship between the H-index in the WoS and the H-index in the Google Scholar database ($p < 0.05$). The Scopus and Google Scholar H-index (0.925 **) is very high. So is the correlation between the H-index and WoS index; however, the correlation between Google Scholar and WoS HTML index is weak. In other words, the correlation between Google Scholar and Scopus HTML index is stronger than the correlation between Scopus HTML index and Google Scholar and between Google Scholar and WoS.

Discussion

A review of the information obtained from the descriptive part of the research shows that Iranian researchers in the industrial engineering index publish their works and documents in Scopus, WoS, Google Scholar, and Mendeley. Following Biranvand and Shabandi (2020), we will review parameters such as access to the works indexed in Scopus and the professional connections between these works compared to other databases.

This research specifically examined Mendeley resource management. The data obtained from the research indicates that the researchers do not welcome the use of this resource management database to share their works. In the study, it was found that less than half of the study population, the researchers in the field of industrial engineering, have a personal page in this database. The findings show that the researchers in this field are not familiar with the impact of Mendeley resource management on indicators such as readability, citation attraction. The results obtained from this section are in line with reported earlier (Biranvand & Shanbedi, in the press, b; Htoo & Na, 2017; Pooladian & Borrego, 2017). According to the results obtained

from other studies conducted in this field, due to the direct relationship between this site and being seen on social networks, it can be said that the impact of this site is much greater and deeper than other sites in attracting citations and being viewed (Biranvand & Shanbedi, in press, a; Riahinia, Rahimi, Jahangiri, Mirhaghjoo & Alinezhad 2018; Ruan et al., 2018). A significant relationship has been reported between the presence of documents in social networks and the number of citations in databases in most studies. However, Asaad et al. (2020) found no significant relationship between Altmetric scores and received citations. This might be due to differences between different scientific fields using scientific networks.

Active presence, up-to-dateness of members' personal pages, and activity in the Mendeley resource management database have had a tremendous impact on Scopus, WoS, and Google Scholar indicators. By examining the analytical data of the research, a significant relationship was discovered between the Altmetrics indices and Scopus. The highest correlation was related to the received citation and the number of documents, the H-index and the number of documents, publications, and the number of documents, respectively. The findings are in line with those reported in the literature (Riahinia et al., 2018; Ruan et al., 2018). Examining the relationship between Mendeley database indexes and WoS, we concluded that being active in the Mendeley resource management database is correlated with some of the indices in WoS. The highest correlations were related to the HTML index in both databases. The findings align with those reported earlier (Mohammadi & Thelwall, 2014; Riahinia et al., 2018). There was also a high correlation between Mendeley and H-index and i1o index indicators in Google Scholar. There is also a high correlation between publishing works in Mendeley and H-index and the i10 index in Google Scholar. Similar results were reported by Saberi and Ekhtiyari (2019).

Conclusion

According to the results of this study, we can point to the effect of databases on the citation and visibility indicators according to receiving citations from each; The correlation between indices of Mendeley resource management database and those of other databases is very high. This strong correlation can be seen between WoS and Scopus's number of citations received. By discovering the relationship between the H-index score on the Scopus, WoS, Google Scholar, and Mendeley, the results confirm the relationship of the databases with one another. Although the relationship between the H-index score between Google Scholar and WoS or WoS and Scopus is stronger, the positive relationship between the Mendeley and H index score is also considerable. Considering the prominent role of the Mendeley resource management database in increasing the number of readings and receiving citations, which leads to an increase in the authors' H index score, researchers are recommended to use this site to index and share their works. By sharing resources in this database, it is possible to help improve the validity and consistency of in-text citations. It is also considered a way to improve communication between authors in scientific fields. Deficiencies in the management of scientific resources used in citations by researchers constitute a significant concern, as it results in the isolation of researchers. Mendeley is a great help for researchers to overcome this problem.

In this study, we faced challenges such as lack of access to information of some databases, lack of up-to-date researchers 'profiles, variation in the written form of researchers' names. Researchers' increased interest and continued use of these databases will address many challenges. In future work, different scientific-citation networks can be studied and compared based on other scientometric indicators. It is also possible to study the research information of

researchers in other fields. This research helps researchers become more aware of their research activities and contribute to the development of science in any field.

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